

NEW BRIDGE OVER MURRAY RIVER AT MILDURA-BURONGA

**GEORGE CHAFFEY BRIDGE
OFFICIAL OPENING 12 MARCH 1985**



MINISTERIAL MESSAGE

This magnificent multi-million dollar crossing of the Murray River on the Sturt Highway at Mildura-Buronga is the result of close co-operation between the Federal Government and the Governments of New South Wales and Victoria.

The Federal Government funded the five bridges which comprise this project — one over the Murray, three in New South Wales and one in Victoria — at a cost of \$9.5 million. The funds were provided under the Australian Bicentennial Road Development Program. The State Governments, which were in charge of construction, funded the associated approach road works at a cost of \$4.8 million.

This joint Federal-State Bicentennial undertaking is a tangible example of how co-operation between these Governments can improve our interstate links and serve national as well as regional interests.

These road works will greatly improve safety and travelling conditions for the thousands of people who use this vital route, which runs for over 1,000 kilometres through three States.

Good road transport is essential to the vitality of any region and these new bridges and road works will greatly help the local economy, especially the fruit industry and tourism which is growing in importance in the beautiful Sunraysia region.

A further benefit will be reductions in the frequency of road bridge closures due to flooding.

The main bridge over the Murray between Mildura in Victoria and Buronga in New South Wales has been named after George Chaffey, the pioneer genius who brought the benefits of irrigation to the Mildura district in the late nineteenth century.

All those associated with this project are to be congratulated for their fine work. In part, the excellent level of co-operation between the Federal and two State Governments, and their respective departments, resulted in the bridge being completed ahead of schedule.

*Peter Morris, Minister for Transport,
Commonwealth of Australia.*

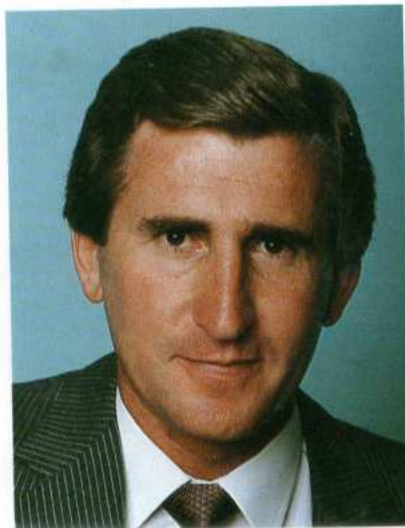
*Laurie Brereton, Minister for Roads,
New South Wales.*

*Steve Crabb, Minister of Transport,
Victoria.*

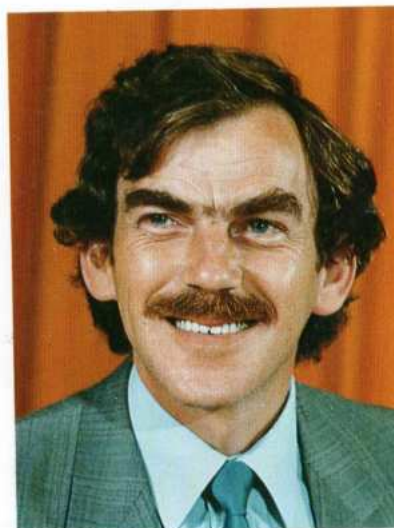
March 1985



**The Hon. Peter Morris, M.H.R.
Federal Minister for Transport**



**The Hon. Laurie Brereton, M.P.
Minister for Roads, New South Wales**



**The Hon. Steve Crabb, M.P.
Minister of Transport, Victoria**

Front Cover:
*Old and new bridges at Mildura. [Reproduced by courtesy
of Transbridge Division of Transfield (N.S.W.) Pty. Ltd.]*

*George Chaffey. (Reproduced by courtesy of Mitchell
Library, Sydney.)*

GEORGE CHAFFEY, MAKER OF MILDURA

George Chaffey, the man whose ideas and innovative work with his brother William Benjamin led to the transformation of an inhospitable tract of mallee scrub into the verdant city of Mildura, was born in Canada in 1848. The son of a ship builder and owner, this talented man combined hard-headed business acumen with sound engineering skill and great foresight.

After an apprenticeship as a marine engineer and several years spent in designing and building steamships, George Chaffey became interested in irrigation. In 1882, along with his horticulturalist younger brother William, he founded Etiwanda and Ontario — two model fruitgrowing colonies in California, which were successfully developed by his innovative irrigation techniques.

Other highlights of Chaffey's early days in California were his involvement with the electric lighting of Los Angeles and his part in the installation of the first long-distance telephone in the State, but his interest in irrigation schemes remained.

It was in early 1885 that Alfred Deakin (later to become the second Prime Minister of Australia) met the Chaffey brothers while visiting America. Deakin was then Minister of Water Supply in the Victorian Government and was in America to study irrigation methods, as chairman of a royal commission. Deakin was impressed by the Chaffeys' achievements in California and discussed irrigation possibilities in Victoria. Seeing the potential for a profitable venture, George Chaffey arrived in Melbourne in February 1886, and was followed shortly after by William.

George Chaffey's choice of Mildura, then a remote, run-down and drought-stricken sheep station, for Australia's first major irrigation scheme was surprising. But the area was bounded by the great Murray River, and burgeoning vines and fruit trees

in the garden of the old homestead demonstrated the fertility of the red soil. George Chaffey was attracted by the challenge of the wide empty plains, reminiscent of the Californian desert and, with his brother, he acquired 250,000 acres from the Victorian Government in May 1887.

His engineering genius soon devised a system of four centrifugal pumps, driven by two large 750 hp triple expansion steam engines, to lift water from the Murray. This Chaffey-designed pumping system confounded sceptics and continued to work for 70 years, from 1889 to 1959. One of these engines and other relics of the early settlement can be seen today at Rio Vista, the old Chaffey homestead which is now part of the Mildura Arts Centre.

The Chaffeys organised the clearing of the ground, the digging of irrigation channels, the planting of grape vines, citrus and stone fruit trees, and the selling of the land to settlers. George Chaffey also involved himself in the planning of the new town. Today, the City of Mildura is characterised by its American-style grid pattern of north-south named avenues and east-west numbered streets. Deakin Avenue with its splendid central flowerbeds remains the longest such avenue (12.1 km) in any Australian city.

Mildura's early progress was rapid. By 1890 it had a population of 3,300 and the Murray was busy with river traffic. Blocks of land in town, initially priced at £20, were fetching £300 and the previously arid landscape was giving way to the green of gardens and orchards. A similar but smaller irrigation colony (on land acquired in February 1887) at Renmark in South Australia was prospering under the management of a third brother, Charles Chaffey.

But from 1893 onwards, a series of setbacks combined to spell disaster. The river fell to a level too shallow for the paddle-steamers to operate;

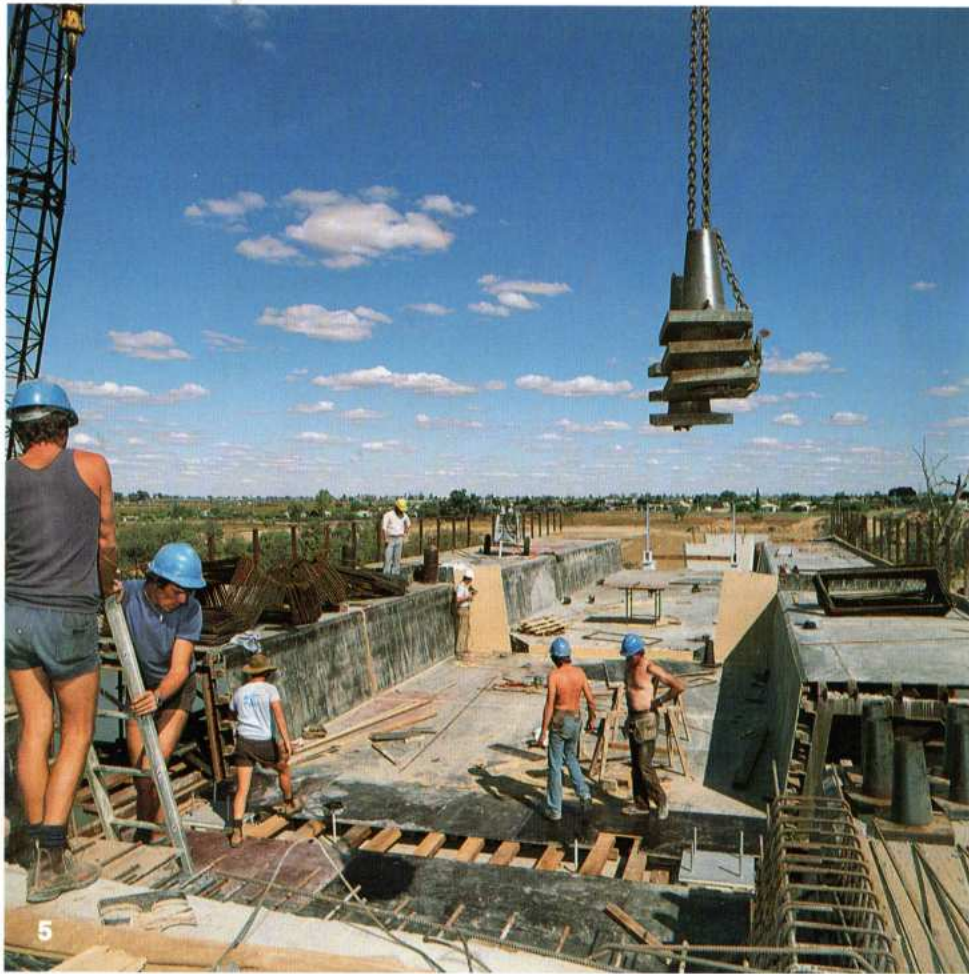
without the promised railway, the only outlet to carry the ripe fruit to market was along undeveloped overland tracks; some irrigation channels began to leak; and in some cases salt was rising from the subsoil and killing the fruit trees. Lacking transport, the 1893 harvest of pears and peaches rotted and few settlers could afford to keep up the payments on their blocks. On the wider front, there was a general collapse in the Victorian land boom and the banks closed. With more pressing commitments, no government funds were available to aid the ailing enterprise on the Murray.

The people of Mildura worked hard and overcame many of the physical problems through co-operation and effort, notably by developing techniques for drying and packing fruit, but the personal fortunes of George and William Chaffey, who had financed Mildura as a private enterprise, were exhausted. In 1897 George Chaffey left Australia, penniless and frustrated by the coincidence of events which foiled his plans. (William, however, remained and tenaciously endured a further period of hardship to resume his place as a leader of the settlement. He is commemorated by a statue in Deakin Avenue, Mildura and another in Renmark.)

George Chaffey returned to California and made a fresh start, continuing his innovative work in irrigation and later going into banking. He died in 1932 leaving three sons, one of whom became a pastoralist in Australia.

Although he found it necessary to leave the colony after only eleven years, George Chaffey's contribution to the founding and future development of Mildura was widely recognised. In 1907 Deakin, then Prime Minister, commended his enterprise and "the daring work" which he "inaugurated on the Murray". It is fitting that Mildura's impressive new bridge should be named after this able and far-seeing engineer, inventor, entrepreneur and irrigation pioneer.





1. Road traffic was at a minimum in Mildura in 1923, as this photograph of Deakin Avenue shows. (Reproduced by courtesy of Mitchell Library, Sydney.)

2. Prior to the opening of the old bridge in 1927, a punt transported people and goods across the Murray River at Mildura. (Reproduced by courtesy of Mr. D. Turvey, Mildura.)

3. Paddleboats have often had a tight squeeze to fit under the old structure and thereby save the delays caused by the outdated lift-span.

4. One of four timber approach bridges on the New South Wales side, which have been replaced by three new bridges.

5. Construction underway on the George Chaffey Bridge in April 1984.

6. The new structure allows greater clearance for river traffic.

7. One of the new approach bridges, with its predecessor in the background.



MILDURA AND BURONGA

After the problems of 1893, Mildura's fortunes were gradually restored. Although the difficulties were far from over, reconstruction on self-help lines put the settlement on the road to success. The arrival of the railway in 1903, the successful introduction of sultanas, and construction of locks and weirs on the Murray in the 1920s secured Mildura's future.

Today the City of Mildura has a population of nearly 17,000 and is the centre of an extensive irrigation area, renowned for its dried fruit, citrus products and wine. Due to its warm, dry climate, it is also a popular tourist centre, a major attraction being the historic paddle-steamers which ply the river.

The name Mildura is an aboriginal word said to mean either "red rock" or "sore eyes". The name

was given to the original sheep run in 1858 by the Jamieson brothers, Hugh and Bushby. A replica of their station homestead, built in 1847 and later used by the Chaffey brothers, is a feature of the recently opened Old Mildura Homestead historical park project.

Situated just across the Murray River from Mildura, in the Shire of Wentworth, is the village of Buronga, which was known as Hendy Town until 1935. It was one of the irrigation projects sponsored by the Murray Valley Development League, producing mainly fruit, vegetables and pasture grasses. A feature of Buronga, which now has a population of approximately 600, is the large-scale glass-house production of tomatoes on the river flats.

THE OLD BRIDGES

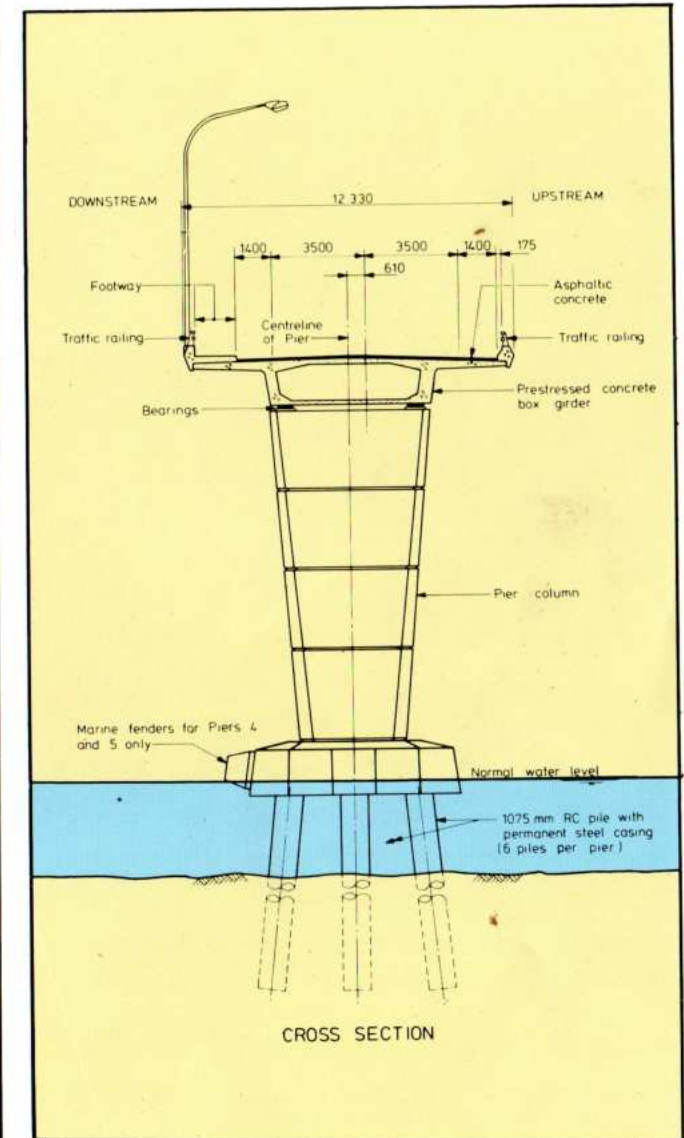
In the early days, people and goods were transported across the Murray River at Mildura by a punt which operated from near the wharf on the southern bank. This service became inadequate and work commenced on a bridge in January 1925. The bridge, which is now being replaced, was built for the NSW Department of Public Works by Armstrong-Whitworth Pty. Ltd. for £45,995. It was opened by the visiting Secretary of State for the Colonies, Mr. L.G.M.S. Amery, M.P., on Saturday 22 October 1927.

The existing bridge has a total length of 250 m and consists of four 37 m long steel truss spans, a central 18.3 m long lift-span and 11 short approach spans. The substructure is of reinforced concrete piers supported by 7.6 m long red gum piles driven into the river bed. The lift-span is wide enough for only one lane of traffic and traffic signals were

installed in 1979 to control the flow of vehicles. There is no pedestrian footway on the old bridge although eight additional pedestrian refuges were provided in the early 1970s to supplement the ten initially provided.

As the demands of modern-day traffic have increased, the narrowness of the bridge has created a troublesome and time-wasting bottleneck. The problem has been compounded by the need to operate the lift-span for water traffic (especially the growing number of tourist paddle-steamers), thus frequently interrupting the flow of road traffic.

The four approach bridges over the adjacent flood plains in New South Wales, all timber beam structures, have in recent years also become inadequate and in need of replacement.



THE GEORGE CHAFFEY BRIDGE

The site chosen for the new bridge is 120 metres upstream of the existing crossing and in line with San Mateo Avenue. This route will allow heavy traffic to bypass the city centre while still allowing local and tourist traffic easy access. On the New South Wales side, the new approaches extend to the junction of the Sturt and Silver City Highways in Buronga.

A principal design consideration of the new bridge was the need to allow clearance for river traffic passing beneath it and so eliminate the need for a lift-span. A minimum vertical clearance of 8.5 m above the 1956 flood level of 39.4 m was required. However, the new bridge has an upward curve over the river with a clearance in the centre of approximately 14 m above the normal water level of 34.8 m. A minimum navigational width of 18.9 m was also provided between the piers. The accompanying diagrams show how the design of the bridge, which was undertaken by the New South Wales Department of Main Roads, meets these requirements.

The new bridge is 331 m long and the total width of the deck is 12.3 m. This comprises a 9.8 m wide, two-lane carriageway and a 1.5 m wide footway. Each traffic lane is 3.5 m wide with a 1.4 m wide shoulder.

The bridge was constructed under contract by the Transbridge Division of Transfield (N.S.W.) Pty. Ltd. of North Sydney for a cost of approximately \$4.5 million. Work began on the site in April 1983 and has been completed three months ahead of schedule.

Technical Details

The bridge has nine spans; seven of these are 37 m long and there are two end spans, each 30.8 m long. All nine spans are joined together by steel prestressing cables to form a continuous length of nearly 322 m without intermediate deck joints.

The bridge is a single prestressed concrete box girder with the deck cantilevered out from each side. The box girder is supported by nine tapered reinforced concrete piers. Longitudinal movement of the superstructure is restrained at two of the piers at the centre, whilst the other piers have sliding bearings which allow the bridge to expand and contract. Deck expansion joints are provided at both abutments.

Foundation investigations revealed that the river bed consists of dense to very dense sand to a depth of over 30 m, with some thin layers of cemented sands. End-bearing piles on rock were therefore not economical. The piles consist of 1075 mm diameter steel tubular casings driven to approximately 31 m below normal river level. These casings were then excavated to within 3 m of the toe and filled with reinforced concrete.

Each pier is supported by six piles and each pile (except those at the abutments) is on a 1:10 rake and designed for 9 m of scour, to guard against settlement of the pile group. Of the piles at each abutment pier, three are vertical and three are on a 1:6 rake. It was assumed that the development of skin friction on the outside of the shaft was sufficient to sustain the load from the bridge without taking account of the additional capacity of the bottom of the pile to carry the load. To confirm the design assumptions, two types of load capacity tests were carried out on two piles. These were a conventional static load test and an advanced type of dynamic pile driving test, using a new American analyser recently purchased by the Road Construction Authority of Victoria.

While a total load capacity per pile of at least 210 tonnes was specified in the design, a load of 300 tonnes was successfully carried during the static tests. In addition, the piles are designed to sustain, without damage, the impact of a 120 tonne vessel striking the piers at a speed of 10 knots.

THE APPROACH BRIDGES

On the New South Wales side, Approach Bridge 1 at the Buronga end is 36 m long and consists of three 10 m spans of prestressed concrete planks with a compositely acting reinforced concrete deck.

Approach Bridge 2 is of similar design but is 126 m long, has 12 spans and is on a 2000 m horizontal curve.

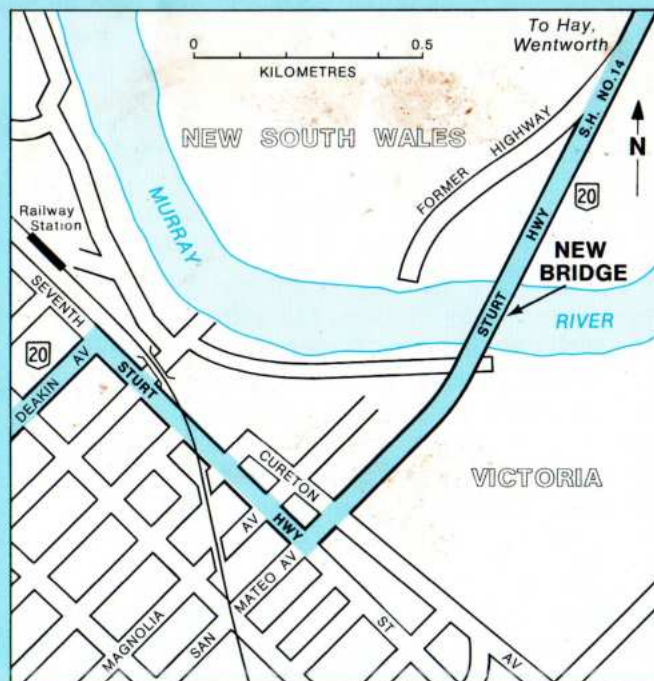
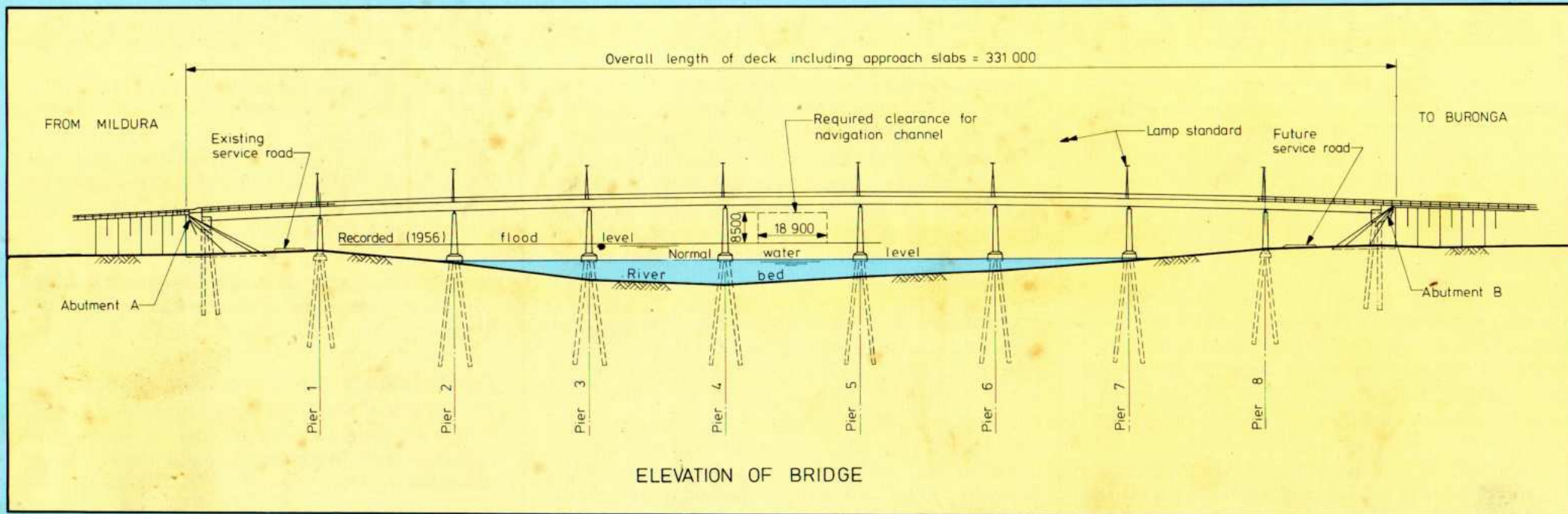
Approach Bridge 3 is 86 m long and consists of four 20 m spans of simply supported prestressed concrete girders with a compositely acting reinforced concrete deck. This bridge has a footway on the downstream side.

These three bridges were designed by the New South Wales Department of Main Roads and built by Pearson Bridge Pty. Ltd. of St. Leonards, Sydney for a total sum of \$1.1 million. They all provide for two lanes of Highway traffic.

The associated roadworks linking these bridges on a better and much safer alignment than was available on the old route of the Highway has cost approximately \$3.7 million.

The Victorian approach bridge has been designed by and built under contract to the Victorian Road Construction Authority. It is 88.4 m long and consists of four 14 m spans with two end spans of 12 m, each composed of reinforced concrete girders and concrete deck.

To maintain a uniform appearance along the new section of Highway, the carriageway width and kerb details of this bridge match those of the New South Wales bridges. With associated roadworks, it has cost \$1.8 million.



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 LOT 11
 for the new bridge



DEPARTMENT OF MAIN ROADS,
 NEW SOUTH WALES.
 MARCH, 1985